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SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
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EROSION CONTROL PRACTICES DIVISION

The Effect of Previous Cropping Systems on Soil and Water Losses - F. W. Schaller, Ames, Iowa.-"The effect of previous cropping systems on soil and water losses as measured on the control plots at Clarinda during 1949 are presented in Table 1. The soil and water losses occurred almost exclusively under corn. Soil loss from corn grown in a C-O-M rotation averaged 13.7 tons per acre. Soil loss from corn grown continuously for the past seven years (1943-49) was 2 - 3-1/2 times greater than from rotation corn. Prior to seven years of continuous corn these plots were in alfalfa or Kentucky bluegrass for eleven years. It appears from the data that the alfalfa has given greater residual protection from erosion than has the bluegrass. There was no soil or water loss measured on the meadow plots. The only loss under oats occurred on a plot which had been desurfaced at the beginning of the experiment.

Table 1.--The effect of previous cropping systems on soil and water losses. Experiment I, Marshall silt loam, Clarinda, Iowa, 1949

Previous Cropping System	Soil Loss T/A	Runoff %*
From Corn		
Corn 1931-42; Rotation C-O-M 1943-49	10.95	3.47
Rotation C-O-M 1931-49	13.71	6.35
Alfalfa 1931-42; Corn 1943-49	31.09	8.01
Corn (desurfaced) 1931-42; C-O-M 1943-49	48.70	8.75
From Oats		
Corn 1931-42; C-O-M 1943-49	None	None
RotationC-O-M 1931-49	None	None
Desurfaced, corn 1932-42; C-O-M 1943-49	0.23	0.92
From Meadow		
Corn 1931-42; C-O-M 1943-49	None	None
Rotation C-O-M 1931-49	None	None

* Runoff= Percent of total precipitation
Total precipitation = 32.58 inches.

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Corn Yield in Relation to Tillage Practices - "The yields of corn obtained under different tillage practices in 1949 have been summarized and are presented in Table 2. The studies this year were conducted at 14 different locations in 8 different counties. The average yield for all locations shows that without fertilizer, plowing and loose ground listing produced 68 bushels of corn per acre. With hard ground listing the average yields were approximately 8 bushels less and with subsurface tilling 13 bushels less. Where fertilizer was used plowing and loose ground listing were again about the same and averaged approximately 70 bushels per acre. Hard ground listing responded well to fertilizer and gave a yield of 72 bushels per acre. Subsurface tilling again gave the lowest yield and produced 13 bushels per acre less than plowing.

Cover crops in Iowa - Some time has been spent during the past month in reviewing and summarizing cover crop data obtained at this station. Cover crop seedings have been made in 28 counties on approximately 25 different soil types during the period 1944-49. These trials have been in addition to the more detailed experiments made during the last 16 years at the Soil Conservation Experimental Farm at Clarinda and those on the Agronomy and Agricultural Engineering Farms at Ames. A report has been prepared and the following is a summary of that report:

Summary and Conclusions

1. Rye-vetch mixture and sweet clover offer more possibilities as cover crops in Iowa than any of the other crops tried.

2. Variations in soil moisture greatly affected cover crop stands and the amount of fall growth obtained. Stand failures can be expected in some years and poor stands with very little fall growth can be expected frequently.

3. The best cover crop yield was obtained in 1943 when rye-vetch produced 2.10 tons dry matter per acre in the tops and roots (0.28 tons in roots and 1.82 tons in tops).

4. From August 15 to September 1 is the best time to seed cover crop. However, satisfactory stands can usually be obtained in corn when seeding at the last cultivation.

5. Cover crops, if legumes or a mixture of legumes and non-legumes, increase the nitrate nitrogen content of the soil, reduce soil and water losses and improve the soil tilth.

6. The cover crops should not be permitted to grow too late in the spring as the heavy growth will cause a loss of soil moisture. Furthermore, if a non-legume in the cover crop is allowed to grow too late in the spring, nitrogen deficiency symptons may appear in the following corn crop.

7. Corn yields have only been slightly increased in Iowa trials by cover crops. However, on less fertile soils than used in this study, good cover crops plowed under at the proper growth stage will probably give greater yield increases.

Table 2.--Summary of Yield of Corn Tillage Studies - 1949

County	Cooperator	YIELD OF CORN - BU/A							
		No Fertilizer				With Fertilizer *			
		Plowed	Hard Listed	Sbsf. Tilled	Loose Listed	Plowed	Hard Listed	Sbsf. Tilled	Loose Listed
Audubon	Clarence Henriksen	93.4	89.4	87.3	94.1	88.6	97.1	90.7	93.4
Audubon	Sigurd Molgaard	63.0	50.1	52.3	58.2	66.9	65.6	59.6	62.9
Marshall	Robt. Rider	67.7	61.2	65.5	70.2	76.3	80.6	68.6	74.6
Marshall	Howard Soorholtz	65.7	51.3	56.5	60.5	68.2	51.8	52.7	61.6
Monona	LeRoy Loomis	58.0	59.5	54.1	62.7	78.4	84.5	64.5	74.1
Monona	W.I. Exptl. Farm	39.8	33.0	24.5	46.9	54.6	49.4	33.4	55.9
O'Brien	Ray Raber	54.2	47.8	42.6	51.8	55.6	51.5	40.2	51.3
O'Brien	Louis Witt	55.4	53.2	42.3	57.2	51.2	52.8	41.6	49.1
Page	Soil Cons. Exptl. Farm	96.6	64.0	51.3	92.0	95.3	90.8	61.3	96.8
Plymouth	Gordon Elliott	58.4	56.9	40.4	57.5	57.0	70.1	39.8	61.7
Plymouth	Tom Kenny	69.5	59.5	46.2	67.2	64.8	70.5	46.0	53.6
Ringgold	G.S. Exptl. Farm	93.2	92.1	77.5	89.0	94.3	97.4	74.4	70.1
Sac	Kermit Johnson	65.8	65.1	56.8	73.3	72.3	72.9	64.3	75.7
Sac	Rabe Bros.	72.6	64.5	75.2	70.9	78.4	71.4	71.9	79.4
Average		68.1	60.5	55.2	68.2	70.8	71.9	57.8	68.6

* Represents 125 lbs./A of 4-16-0 with planter attachment plus 100 lbs./A 33-0-0 broadcast at planting time.

The Effect of Crotalaria Used in Land Resting - O. R. Neal, New Brunswick, New Jersey.-"A field test studying the effect of crotalaria as a land resting and organic-matter-producing crop was conducted on a farm near Cape May. In 1948 crotalaria was seeded on a portion of a field which had been cultivated to lima beans the previous year. The remainder of the field was cropped again in lima beans. The crotalaria made a rank dense growth. This was disked into the soil during early fall. A winter cover crop of rye was seeded on the entire field after the lima beans were harvested.

"The field was planted to lima benas this year and identical treatments were given to both the rested and the continuously cultivated strips. Yields were measured with results obtained as shown in the following table:

Treatment	Yield per acre of baby lima beans-1949	Volume weights	
Crotalaria	608 lbs.	1 to 4"	1.53
		4 to 7"	1.50
Continuously cultivated area	555 lbs.	1 to 4"	1.65
		4 to 7"	1.61

"An analysis of variance shows that the increase in yield from the rested or crotalaria area is not significant at a 5% level. The drought was very severe during the summer and lowered yields considerably.

"It is planned to continue this study next year since improvements in the physical condition of the soil were noted following the crotalaria treatment. The farmer first noticed the difference in that the rested land plowed and worked up easier in the spring than the continuously cultivated land. During July a soil sampling tube could easily be pushed to a depth of 10 to 12 inches on the crotalaria land but the tube would stop at a depth of 4 to 6 inches on the continuously cultivated area.

"Soil samples were taken for laboratory study when the yield tests were made. An aggregate analysis of the pipette method showed no difference in the percent aggregation but the wet sieve method showed a difference in the degree of aggregation in favor of the crotalaria treatment. An average of the results obtained from an analysis of four samples from each treatment gave a degree aggregation of 46.4% for the crotalaria treatment in comparison to 37.8% for the continuous cultivation.

"Volume weight determinations made on natural structure cores showed that the soil of the continuously cultivated area was at a greater density than that of the crotalaria treatment as shown in the above table. The difference in volume weight between these areas is inversely related to the yields as would be expected if physical conditions were limiting. The volume weight measurements, therefore, indicate that the yield difference may be related to the physical condition even though the yields were not significantly different. Certainly the more porous soil under the crotalaria treatment would absorb water more readily and be less susceptible to erosion."

Water Needs - E. A. Engdahl, New York.-"Now that the growing season and drouth are over, as far as crops are concerned, it might be well to record actual conditions that were the cause for worry to many New York State farmers. April and May rains exceeded estimated water needs, soil was moist, temperature low and crop needs light. Plowing, fitting and seeding conditions were excellent. No worries.

"Come June, water needs exceeded rainfall by slightly more than 4 inches. Out of the 8 days that it rained, 4 days produced only .14 inches. Temperatures were high. The crops made a heavy demand on soil moisture and the land became dry. We begin to worry.

"July water needs exceeded rainfall by 2.3 inches. Wheat and oats were harvested during this period, two weeks earlier than in 1948. Clover and grasses in the seedings showed need for moisture. Corn in the tassel stage, with moisture needs at a maximum, indicated definite moisture deficiency. Potatoes and pastures were in the same predicament. Really worried.

"While August shows an excess of rain over that needed, actually more than half of this rain came the last two days of the month. Corn in the filling stage, potatoes and pastures all showed need for water. Temperatures were still high and soil dry. Still worried.

"Come September, the late rains of August carried over, and, plus the September rains (16 days), moisture conditions improved but too late for appreciable help except to potatoes. While October shows a rainfall deficiency, temperatures were too low for corn growth, the only crop left to harvest.

"In general, yields were low and no doubt reflect water need. On the other hand, soil fertility can reduce water needs as Dr. Lamb points out in our November report "Irrigation Not a Substitute for Good Soil Conditions".

Factors Affecting Crop Growth - Arnot - 1949

Month	Est. Water Needs	Rain-fall	Mean. Temp.	Days of Rain	Days & Amt. .10" or less		Soil Condi-tion	Crop Needs	Temperature
					No.	Amt.			
April	1.26	2.31	44.0	15	10	.64	Moist	Light	Low
May	3.03	3.80	55.5	16	8	.39	Moist	Light	Moderate
June	5.00	.94	68.5	8	4	.14	Dry	Medium	High
July	5.67	3.37	72.5	14	5	.21	V.Dry	Heavy	Very High
Aug.	4.73	6.28	69.0	8	2	.09	Dry	Heavy	High
Sept.	2.40	4.27	55.0	16	9	.53	Moist	Medium	Moderate
Oct.	2.09	1.47	54.0	8	2	.09	Moist	Medium	Moderate

Some Favorable Weather Factors in 1949 - G. R. Free, Marcellus, New York.-"In looking back over the weather records for 1949 at Marcellus, the 25 days with no rain from May 24 to June 19, and the other dry period from August 1 - 27 with only .58" in small showers tend to be outstanding events. However, totals of precipitation for each of the three months June, July, August, were 2.76, 3.41 and 3.44 inches respectively. Temperatures were considerably above normal as the following tabulation shows.

MONTHLY MEAN TEMPERATURE °F

	1937-1949 Average	1949
May	54.8	57.0
June	65.0	70.6
July	70.1	73.0
August	69.0	71.2

"Undoubtedly these higher temperatures meant increased transpiration and evaporation, but, judging from very satisfactory yields of wheat, corn and alfalfa hay, they also meant efficient use of moisture for crop production. The temperatures for June, July, and August check closely with those listed by Wallace and Bressman in their book, "Corn and Corn Growing" as being ideal for corn in the Corn Belt.

"Another factor contributing to yields of shelled corn of over 100 bushels per acre on some plots was the negligible loss of moisture by runoff from contoured corn even on steep slopes. The rain which really broke the June drouth occurred on June 26. The total for this storm was 1.95 inches and 1.17 inches fell in 30 minutes. This was a '5-year' frequency storm, and it caused considerable washing on 'up and downhill' planted plots.

"All of these data indicate that when favorable growing conditions prevail, it is well to have good soil structure and depth for moisture absorption and storage, and to follow other conservation measures so that runoff losses are not excessive. Proper and adequate fertilization is also essential."

Tomato Irrigation in Wayne County - E. A. Carleton, Geneva, N. Y.- "Data from the cooperative irrigation of tomatoes at Walcott, N. Y. were reported in the September report for blossom-end rot and for time of ripening. Dr. M. T. Vittum reports yields of two varieties in terms of U. S. No. 1 equivalent and the increase obtained from irrigation as follows.

Treatment	Stokesdale, Tons/acre	Red Jacket, Tons/acre
Irrigated	13.39	17.61
Not irrigated	7.50	13.05
Yield increase	5.89	4.56

"Plots were irrigated three times during the season with the following amounts applied on these dates.

Date of Watering	Amount Applied Inches
July 20	1.60
August 5	1.00
August 16-17	1.40
Total	4.00

"A comparison of the total rainfall as measured at the project in Walcott with that measured at Geneva for each 10-day period from June to October 1949 is given below.

Period of Measurement	Walcott, N.Y. Inches	Geneva, N.Y. Inches
June 1-10	-	.00
10-20	.33	.03
20-30	.30	1.21
July 1-10	.53	2.12
10-20	.64	.31
20-31	.75	1.88
August 1-10	.00	.00
10-20	.38	.76
20-31	2.18	1.88
Sept. 1-10	.94	.33
10-20	1.70	.84
20-30	1.18	.43

Hints on Farm Pond Construction - Howard Wilson, Jr., New York.- "In August the Schuyler County Soil Conservation District built three ponds at the Arnot. These ponds are about 1/3 of an acre each. The most of the cost was paid by the new Conservation Department at Cornell and the ponds will be used for studies in farm fish pond management.

"Howard Meeks, our star dozer operator, was handling the big Caterpillar D-7 with the 12-foot blade with his usual skilled efficiency. John Lamb and I got to talking about a lot of little things in pond building that never get on the blue prints but mount up in the cost figures. John asked me to list all we could think of at the time.

1. At the top of the list we place a skilled operator. And it pays to keep him building pond after pond to gain in experience.

2. Use a machine adequate for the job. The big dozer, D-7 or TD-18 will usually move dirt cheaper than the smaller HD-7 and Cletrac 60.

3. Treat the operator like a friend. Riding one of those iron broncos gets tiresome. A cup of coffee and piece of pie in the mid-afternoon served by the farmer's wife can pay good dividends.

4. The operator should have a good idea what the technician's job is, and how to use a level and rod. However, he should not be used as a rodman, except in emergencies. The farmer will save money by hopping the rod himself.

5. The technician should train the operator to read the farm pond plan. Then the operator can have a better picture of the final results wanted and do the job easier and quicker with less waste motion.

6. Have a way of draining the pond during construction. A big machine wallowing around in the mud means extra cost.

7. Have the site ready when the dozer arrives. Get the old post piles and junk out of the way.

8. Have the trickle tube complete or ready to go in right at the start.

9. Use the farm tractor for the little jobs, pulling a fence out of the way, or towing the welding outfit across soft ground.

10. A farmer can save money by helping clean mud out of the cat rollers when it needs to be done.

11. Sometimes a farmer can save trailer truck hire by tracking over a neighbor's farm. He should have the gates open, or fences down, and planks ready to cross black-top roads.

12. On a hillside site where a dam or three sides is necessary, a semi-circular or horse shoe shape dike will save on dirt pushing distance. Also the cost of fill saved will more than make up for the loss in capacity.

13. The dam and spillway are more apt to get seeded if the lime, fertilizer seed, mulch or manure are on hand when construction starts."

Costs and Miscellaneous Data on Terrace Construction in Wisconsin - H. O. Anderson, LaCrosse, Wisconsin.-"Terraces can be built in Wisconsin without much financial strain or need for special credit facilities. Data obtained by farm planners in various Soil Conservation Districts indicate that terraces are being built at very nominal costs. In the past, construction in some districts has been done, largely, with county owned equipment. In other districts, ordinary farm tractors and plows have been used almost exclusively. In most areas, very little terrace construction has been carried on with privately owned equipment on a custom basis.

"The average cost per 100 feet of terrace built by 20 farmers using county owned equipment was about $1.40 or about $5.00 per acre of land benefitted. This includes only cash costs to the farmers. In addition, he usually puts in some time in getting the terraced areas ready for seeding.

"Rental per hour for the county equipment, including one operator, averages about $5.00 per hour. According to machinery experts, this machinery rental fee covers all costs including depreciation. From two and a half to three hours are required in the construction of 1000 feet of terrace with this type of equipment.

"Data were obtained on 7 terraces built with a whirlwind plow. The cost of these averaged $11.00 per acre or $2.70 per 100 feet of terrace. About 7 hours of work was used per 1000 feet of terrace and the average rental charge per hour was about five dollars.

"The cash costs of building terraces with a farm tractor and plow averaged about $4.00 per acre benefitted or about $1.00 per 100 feet of terrace. On the average, 15 hours of tractor work was used per 1000 feet of terrace. Time requirements and costs on one farm on Spencer soils were much less than the above figure - probably much less than can be expected normally.

"The cost of constructing diversion terraces was about twice as high in four cases on which data were obtained as the average for the construction of regular terraces. While the data on the area benefitted by these diversions were incomplete, it was evident that the area served by was greater than for ordinary terraces and for that reason the cost per acre may not be much greater, if any, than for other terraces.

"The variations in terrace construction costs from farm to farm are large, relatively, due to a number of factors. Among these are differences in:

1. Soil and slope condition.
2. Amount of straightening and leveling undertaken.
3. Equipment and in experience of perators. Usually, much less time is required in the construction of the second terrace than for the first.
4. Condition of soil as far asmoisture, tilth and crop residues are concerned.
5. Length of terrace.

"Good terraces can be built with any of the types of equipment mentioned in this report. Properly planned and constructed terraces will last indefinitely if properly maintained. While economy in construction of terraces is important, quality of workmanship should be given first consideration. A little extra care and expense in eliminating sharp curves, smoothing or otherwise improving a terrace system will bring extra returns over a long period of time.

"According to experiments, crop yields are from 10-15 per cent higher on terraced than on non-terraced land. On the basis of a ten per cent increase with yields of 50 bushels of corn, 50 bushels of oats and 2.5 tons of hay in a four year rotation, this yield difference is worth $2.75 per acre per year even at very moderate prices. * Assuming no yield advantage for the first year, the terraces will in three years time, more than pay for construction costs of five dollars per acre.

* Corn at .60 cents per bushel; hay at $12.00 per ton; oats at .40 cents per bushel.

Table 1.--Terrace construction costs and miscellaneous data, Iowa, Rock Vernon Soil Conservation Districts

	County grader		Whirlwind plow	Private grader
	Av. 7 farms	Range	2 farms	1 farm
Acres benefitted	18	4-70	40	20
Acres benefitted per 1000 ft. of terrace	3	2-7	3.0	2.2
Terrace length, feet	2300	767-1400	---	---
Time per farm, hours	21.2	6-77	61.5	4.4
per 1000 feet, hours	3.5	3-7	4.6	4.3
per acre, hours	1.2	.4-1.7	1.5	2.2
Cost per farm	$99	$24-317	$243	$330
per 1000 feet	17	12-26	18 1/	36
per hour	4	3-5	4.50	7.50
per acre	5	2.50-13	6.00	16.50

1/ The common rate for whirlwind terracer in Rock County was $25.00 per 1000 ft.

Table 2.--Terrace construction costs and miscellaneous data, Western and Northwestern Wisconsin - Barron, Eau Claire and Pepin Soil Conservation Districts

	Patrol grader 9 farms	Whirlwind plow 5 farms	Ordinary plow 2 farms	Bulldozer 1 farm
Acres benefitted	6.2	3.7	2.5	12
Acres benefitted per 1000 feet	2.1	2.4	2.5	2.4
Terrace length, feet	981	522	500	1250
Time, total hours	7.0	12.1	15	16
per 1000 feet, hours	2.4	7.7	15	3.2
per acre, hours	1.1	3.3	6.0	1.3
Cost, per farm, total	$28.05	$46.41	$15.00 1/	$104
per 1000 feet	9.50	30.00	15.00 1/	21
per hour	4.00	3.75	1.00 1/	6.50
per acre benefitted	4.50	12.80	6.20 1/	8.64

1/ Cash costs only.

Table 3.--Terrace construction costs and miscellaneous data, Spencer soil area-Clark, Lincoln and Marathon Soil Conservation Districts

	Patrol grader 20 farms		Farm tractor and plow 1 farm
	Ave.	Range	
Area benefitted, acres	9	--	6
Area benefitted, per 1000 feet of terrace, acres	3	2.3 - 20	3
Drainage profile	2	1 - 3	--
Terrace length, feet	878	180 - 1575	667
Time, total per farm, hours	10.2	1 - 25	10.5
per 1000 feet, hours	3.1	2.3 - 20	5.3
per acre, hours	1.1	--	1.8
Cost, per farm	$44.10	$5 - $138	$10.50 *
per 1000 feet	13.60	8 - 33	5.25
Per hour	4.40	3 - 6	1.00
per acre benefitted	4.90	2.50 - 9	1.65

* Cash costs.

Table 4.--Diversion terrace construction costs and miscellaneous data, Iowa and Vernon Soil Conservation Districts

	4 farms Ave.	Range
Terrace length, feet	619	550 - 1400
height, feet	1.8'	1.2' - 2.7'
Channel width, feet	6.4'	5' - 8'
grade, %	1.0	1.0
Time, per farm, hours	7.2	3-11
per 1000 feet, hours	7.1	5-11
Cost, per farm	$32.30	$15 - $53
per 1000 feet	32.60	20 - 44
per hour	5.00	3 - 8

Fall Maintenance Grazing on Pastures Receiving Different Treatments and Mixtures - D. D. Smith, Columbia, Missouri.-"Fall maintenance grazing ended on December 24. Growth which accumulates on permanent pastures from September 15 to November 15 is utilized after November 15 to reduce hay use. The record for 1949 is as follows:

Vegetation	Period	Animal days per acre	Lbs/acre Gain	Lbs/acre Loss
Alta fescue & trefoil	11-16 to 12-27	21	--	18
Bluegrass & K. lespedeza	11-16 to 12-12	26	--	16
Bromegrass & sweet clover	11-16 to 12-7	21	0	--
Treated bluegrass (1)	11-16 to 12-24	33	100	--
Bluegrass check (2)	11-16 to 12-24	37	45	--
Bluegrass & trefoil (3)	11-16 to 12-7	21	--	3
Alta fescue	11-16 to 12-13	27	10	--

(1) 100 lbs/acre 33-0-0 fall and spring.
(2) No soil treatment.
(3) Very little Birdsfoot trefoil.

"All plots except bluegrass check pasture have been raised to sufficiency level of phosphate, potash, and calcium. Of interest is the gain on treated bluegrass and bluegrass check. These pastures, particularly the treated plot, made excellent growth during the recuperative period. The amount of growth was larger and the color greener on the plot which receives nitrogen. Average daily gain in weight of 3 pounds on the treated plot contrasted with 1.7 pounds on the check area suggests the difference in feeding value of the grass.

"The average cost of baled hay in Missouri, according to USDA, BAE Report of December 5, 1949 was $16.40 per ton. Thus, pasture production in terms of hay saved ranged from $5 to $8 per acre. This does not credit any pasture with a gain in live weight.

Fertility Level in Relation to Soil and Water Loss - "The significant effect of soil fertility on runoff and erosion is apparent from the data secured at McCredie. It emphasizes that an infertile soil is an erosible soil. The intelligent application of commercial fertilizers, manure and crop residues, combined with proper cropping, have improved these soils, inherently low in fertility, such that their performance is approaching that of the better soils of the state.

"Reduction in runoff and erosion by soil treatment may be considered from three viewpoints:

(1) Density of crop cover. This is of particular importance with small grains. The use of 200 lbs/acre of 0-20-10 fertilizer on wheat in a 4-year rotation of corn-soybeans-wheat and lespedeza-lespedeza, during a 4-year period reduced runoff 15% and soil loss 42%. With oats, runoff was reduced 90% and soil loss 94% during the last 3 years by the use of 200 lbs/acre of 10-20-20 fertilizer on limed plots and with sweet clover grown with the oats to be plowed under before the following corn crop.

(2) Soil conditioning crops. Soil loss under corn following 4 years of meadow averaged 41% greater than corn following 1 year of meadow during a 6-year period in which only the small grain of the rotations was treated with 200 lbs./acre of 0-20-10 fertilizer. During the following 3-year period, in which near adequate amounts of N-P-K fertilizer were used on all crops, the soil loss under the corn following 4 years of meadow was 45% less than that following on year of meadow. Adequate soil treatments have made the long rotation more effective from an erosion control standpoint and practical from a production standpoint.

(3) Reduction in acreage of corn and soybeans with corresponding increases in acreages of grass and legume areas for hay or pasture. The unfertilized corn-oats rotation at McCredue has produced an average annual corn equivalent of 15 bushels per acre and had a plot erosion loss of 7.4 tons per acre during the 9 years of study. Yields at McCredie during the last three years, in which near adequate soil treatments have been used, indicate that the same production of grain may be secured on 1/3 the acreage, and the over-all field erosion (with the other 2/3 of the acreage in grass and legume hay or pasture) reduced to 1/5 or 1/8, depending upon the type and length of rotation utilized. Annual production averaged 43 to 45 bushels of corn equivalent per acre for the 3 systems studied."

Tall Fescue Producing Good Pasturage in Cool Dry Weather - B. H. Hendrickson, Watkinsville, Ga. "In spite of cool dry weather, in November and December, well established tall fescue upland pastures supported 1/2 to 2/3 of a cow unit per acre full-grazing basis, without overgrazing. Winter annual grazing crops made but slow growth during these months.

Direct Education Use of Conservation Experiment Stations - "During its first 10 years of operation, 1940-49 period, the visitor's book at the Southern Piedmont Conservation Experiment Station, Watkinsville, Georgia shows a total of 14,010 visitors of record. These people, mostly farmers, came from various points in Georgia, from neighboring and distant states, and from foreign countries. The purpose of their visits was to inspect the soil and water conservation research program under way on the Station, and see on the land the actual field-and-farm scale applications of practical conservation-farming methods that have been developed and tested. The Station is recognized as a reliable source of information concerning good conservation land use methods.

"It is interesting to note, also, the world-wide interest in soil conservation methods and practices as evidenced by the following list of native homelands of the foreign visitors, who totaled 107 in number, from one to twelve of whom came from each of the following countries:

Western hemisphere: Canada, Mexico, Puerto Rico, Haiti, Guatemala, El Salvador, Costa Rica, Dominican Republic, Honduras, Columbia, Venezuela, Trinidad, Brazil, Ecuador, Peru, Chile.

Eastern Hemisphere: England, France, Portugal, Greece, Isle of Cypress, Algeria, Nigeria-British West Africa, Portugese East Africa, Belgian Congo, Union of South Africa, India, Burma, Korea, China, Philippine Islands, Java, Australia, New Zealand.

"Most of these foreign visitors were selected as outstanding students of conservation, and were sent to this country to study both our conservation research methods and results, and their practical application on farms in various parts of this country. Many of these men have since become leaders in the soil and water conservation movements in their home countries."

Grazing Use and Forage Utilization Record of Mechanically Treated and Untreated Pastures - O. K. Barnes, Laramie, Wyoming.-"Table 1 summarizes the grazing use and utilization records from the first group of mechanically treated pastures started at Archer. These native pastures were treated in July 1939, one with pitting, the other grooved at a spacing interval of two feet. The year 1939 was a record-breaking drouth and it was impossible to install these treatments properly due to the extreme hard, dry condition of the soil. This fact minimized the benefits of the treatment as compared to the range response to pitting put in later under more favorable conditions. Even so the 10-year average shows that the pitted pasture and the grooved pasture carried an average of 22 per cent more sheep. The grooved pasture produced 25 per cent more lamb per acre and the pitted pasture 19 per cent more than the check pasture. Even with this difference, the grooved pasture had 50 per cent more grass left per acre and the pitted pasture 25 per cent more than did the check pasture.

"Table II summarizes the grazing and utilization records from two pastures pitted in 1942 and from the two check pastures. The eight-year average shows the two pitted pastures have carried an average of 32 per cent more sheep per acre than the two check pastures. In lamb gain per acre, the pitted pastures show an advantage of 34 per cent. The utilization studies show that the pitted pastures have had average of 54 per cent more grass left each year than have the check pastures. Little difference is shown in the lamb gain per head, which is to be expected when ample feed is available. However, over the eight-year period the gain per acre advantage for pitting amounts to 80 lbs. more than from the check pastures.

"The data collected in 1949 on vegetative density and compisition have not been completely summarized. However, it is evident that the composition change brought about by the treatment still exists to a considerable degree in 1949.

Table 1.--Summary of Grazing and Utilization on Pastures Treated in 1939 at Archer Field Station.

	Sheep days/acre			Lamb gain/acre			Lamb gain/hear			Lbs/acre grass left end of season		
Year	Pitted	Grooved	Check	Pitted	Grooved	Check	Pitted	Grooved	Check	Pitted	Grooved	Check
1940	53	53	53	35.0	35.5	34.1	65.7	66.6	63.9	--	--	--
1941	104	104	104	43.2	49.5	44.5	54.9	64.0	57.4	317	239	74
1942	91	91	87	61.8	66.3	56.1	67.6	71.5	61.0	489	434	379
1943	82	82	60	47.1	46.1	34.2	57.1	55.1	60.4	276	331	140
1944	89	89	62	33.8	30.9	24.6	38.0	34.8	36.9	241	260	235
1945	84	81	61	36.6	44.0	31.4	46.4	58.0	57.8	331	536	295
1946	59	59	52	26.5	28.8	21.9	49.9	54.1	49.3	172	221	132
1947	89	89	64	39.1	40.1	29.8	52.1	53.5	55.5	No	record	
1948	63	63	47	29.6	30.2	22.3	43.6	44.5	41.9	158	283	198
1949	68	68	53	33.2	35.9	26.5	44.1	47.7	45.4	193	338	286
Ave.	78	78	64	38.6	40.7	32.5	51.9	55.5	53.0	272	330	217

Table 2.--Grazing and Utilization Record from Shortgrass Range Pitted in 1942 Compared to Non-Pitted Range (Average Duplicate Pastures for Each Treatment)

		1942	1943	1944	1945	1946	1947	1948	1949	8-yr. Ave.
Sheep Days Per acre	Pitted	71	86	92	86	66	95	68	64	79
	Check	71	69	59	61	46	70	49	56	60
Lamb gain Per acre	Pitted	32.0	56.4	47.3	43.6	30.0	39.9	33.3	34.3	39.6
	Check	27.9	42.9	28.2	32.1	20.8	29.2	25.2	29.9	29.5
Lamb gain Per head	Pitted	37.4	62.3	38.5	58.1	50.4	57.3	43.6	49.1	49.6
	Check	34.6	56.9	36.0	54.9	52.0	54.7	47.3	49.0	48.2
Lbs per acre perennial grass left at end of grazing season	Pitted	425	446	429	437	269	Inc.	299	640	421
	Check	442	293	219	237	166	Inc.	251	315	274

Tabulated Results of Some Studies in 1949 - F. L. Duley, Lincoln, Nebraska.-"Some of the yields for 1949 are now being summarized and a few of the results are shown in the following three tables.

Table 1.--Comparative yields of partridge pea, hairy vetch, lespedeza, and hubam sweet clover in tons per acre of dry residue material (11.1% moisture) at seed harvest dates.

County	Farm	Partridge pea	Hairy vetch	Lespedeza strain 19604	Hubam sweet clover
		tons	tons	tons	tons
Lancaster	Agronomy farm	2.74	1.77(a)	2.47	1.37
Howard	Babensky	2.67	1.88(a)	1.21	--
Antelope	Snodgrass	4.12	2.31(a)	--	--
Lancaster	Wakelin	4.03	--	--	--
Stanton	Landholm	3.79	--	--	--
Webster	Great Plains Watershed Proj.	2.62	--	--	--
Holt	Sobotka	2.11	--	--	--

(a) Hairy vetch harvested at same dates as other legumes. It continued growth in late fall and total growth for season would have been higher than indicated.

Table 2.--Influence of subsurface tillage on wheat and oat yields.

Means	Bu. grain per acre		Lbs. straw per acre	
	Subtilled	Plowed	Subtilled	Plowed
Wheat				
3 tests with legumes in rotation	30.1	31.2	4110	4310
3 tests with no legumes in rotation	24.8	22.9	2640	2490
Mean of 6 tests	27.4	27.1	3375	3400
Oats				
3 tests with legumes in rotation	37.4	37.2	1880	1910
3 tests with no legumes in rotation	16.2	14.1	1030	1080
Mean of 6 tests	26.8	25.7	1455	1495

Table 3.--Influence of phosphate fertilizer on subsurface tillage.

	Subtilled		Plowed	
	Phosphate	No Phosphate	Phosphate	No Phosphate
	Bu. per acre			
Wheat				
Mean of 2 tests with sweetclover preceding wheat	34.1	25.4	34.1	30.1
Mean of 2 tests with no legume in rotation	27.5	27.5	25.5	24.7
	Lbs. straw per acre			
Mean of 2 tests with sweetclover preceding wheat	4715	3660	4600	4405
Mean of 2 tests with no legume in rotation	3085	2930	2935	2800
	Lbs. straw per bu. of grain			
Mean of 2 tests with sweetclover preceding wheat	138	144	135	146
Mean of 2 tests with no legume in rotation	112	107	115	113

Winter Grass-Legume Mixtures On Land Where Kudzu is Well Established as a Summer Crop - E. C. Richardson, Auburn, Alabama.-"Observational plantings of rescue grass, rye grass, Caley peas, grandiflora vetch, and fescue grass were made on kudzu in 1947. The kudzu growing on an eroded area was disked down to prepare a seedbed.

"Fertilizer treatments consisted of 300 pounds of 0-14-10 per acre at planting time, and each succeeding fall nitrate of soda was applied in November or early December at three rates: no nitrate, 200 pounds of nitrate, and 400 pounds of nitrate. All fertilizer was broadcast on the surface of the soil without cultural treatments.

"Yield determinations of winter crops were made in late March. Yield determinations of kudzu were made in July. These are shown in the following table.

Acre yield in tons when different winter grass-legume mixtures were seeded on kudzu land and fertilized with different rates of nitrate of soda

	Green Weight			Dry Weight (20% moisture)
Fertilizer treatment	ryegrass-vetch	kudzu	total	
200 nitrate	14,170	14,824	28,994	5,799
400 nitrate	16,132	15,696	31,828	6,366
0 nitrate	7,848	14,824	22,672	4,534
	Caley peas-ryegrass	kudzu		
200 nitrate	13,080	16,568	29,648	5,930
400 nitrate	15,260	14,824	30.084	6,017
0 nitrate	8,720	15,260	23,980	4,796
	Caley peas-rescue grass	kudzu		
200 nitrate	13,516	18,312	31,828	6,366
400 nitrate	13,952	17,004	30,956	6,191
0 nitrate	9,592	15,696	25,288	5,057

"The yields of winter crops and kudzu were about 3,000 pounds of dry material per acre each, or a total of 6,000 pounds of hay.

"Nitrate of soda increased the yields approximately 500 to 1,000 pounds of dry material per acre. This increase occurred largely in the grass-winter legume mixtures. Nitrate of soda applied at the rate of 200 pounds per acre was as effective as the 400-pound rate.

"Rye grass produced a very dense sod and appeared to offer more competition to the kudzu in May and June than did the rescue grass. Rescue grass produced a more open sod which allowed the new kudzu growth to come through. Both rye grass and rescue grass produced heavy yields of seed, which resulted in thick volunteer stands in the fall of 1949."

Effect of Vegetative Cover on Soil and Water Loss* from Houston Black Clay on 2.37 Percent Slope - J. R. Johnston, Temple, Texas.-"In the fall of 1948 an experiment was started to study the effects of different methods of crop residue management on water erosion and moisture conservation in the Texas Blacklands. A 2-year cropping system of cotton, oats-Madrid sweetclover is being used on all plots of this experiment. The effects of the various methods of oats-sweetclover residue management were not in evidence in 1949. The 1949 soil and water loss data (Table 1) from the clean tilled cotton and the grass-legume crop are of interest. These data further substantiate the high value of small grain and sweetclover for soil and moisture conservation in the Blackland Prairies.

Table 1.

Date of Storm	Amount of Rainfall	Cotton (Rows Across Slope)		Oats-Madrid sweetclover	
		Soil loss	Runoff	Soil loss	Runoff
	Inches	T/A	Inches	T/A	Inches
3-21-49	2.10	---	---	0.020	0.016
4/24-25/49	2.61	0.509	0.237	0.003	0.017
4/28/49	1.39	0.222	0.178	0.006	0.008
6/14/49	2.53	2.836	0.727	--	--
6/22-23/49	1.72	1.084	0.409	--	--
10/21-22-24/49	4.23	.896	.537	--	--
Totals	14.58	5.547	2.088	0.029	0.041

* Each figure represents average data from 6 plots.

"The proper management of the biennial sweetclover in conservation cropping systems on the highly calcareous clay soils of this area will be dependent on a number of factors. One of these is that of root development and the time the legume is plowed under. When used in a 2-year system such as cotton, oats-sweetclover the date of plowing under will depend on (1) time of maximum root development and nutrient storage and (2) the length of time required for good seed bed preparation following the plowing operation. Management of the biennual sweetclover in a 3-year system of row crop, oats-sweetclover, and sweetclover should be a simpler matter. It is thought the 3-year system will be a good one for Class III land, while the 2-year system of row crop, oats-sweetclover will be a good one for Class II land.

Root-Top Development of Annual and Biennial Sweetclover - "Studies on some of the physiological characteristics of annual and biennial sweetclovers have given some interesting information during the 1949 year. Root-top studies of Hubam (an annual), Madrid and Evergreen (biennials) seeded at 6 different dates show that the biennials have a much more extensive root system than the annuals, see Table 2 for data from two different sampling dates in 1949. It is interesting to note that root development of the biennials was considerably greater in December than in July and that top development in December was less than in July. From the standpoint of root material in the soil, this one years' data indicate late fall plowing

would be better than summer or early fall plowing. Samplings in March, April, and May, of 1950 should give further information which will be of value in properly managing the biennial sweetclovers in conservation farming systems.

"Approximately eight man days spent in November and December consulting with farmers and professional agricultural workers.

Table 2.--Root and top development of three sweetclover varieties seeded at six different dates*

Variety	Seeding Date	Pounds of Dry Matter Per Acre					
		July 5, 1949			December 19, 1949		
		Tops	Roots	Total	Tops	Roots	Total
Hubam	9-15-48	2920	328	3248			
"	10-15-48	3501	339	3840			
"	11-15-48	3993	627	4620			
"	2-15-49	3469	536	4005			
"	3-15-49	1478	401	1879			
"	4-15-49	666	315	981			
Madrid	9-15-48	2251	1221	3472	1190	1979	3169
"	10-15-48	3558	2046	5604	2120	2725	4845
"	11-15-48	2610	1760	4370	1188	2358	3546
"	2-15-49	3929	1659	5588	2226	2437	4663
"	3-15-49	2037	1066	3103	1145	2244	3390
"	4-15-49	1029	470	1499	836	1579	2415
Evergreen	9-15-48	3437	1619	5056	2095	2202	4297
"	10-15-48	2895	1613	4508	1843	2092	3934
"	11-15-48	2909	1487	4396	1458	2024	3482
"	2-15-49	3533	914	4447	1405	1803	3208
"	3-15-49	2262	885	3147	1021	1764	2785
"	4-15-49	695	308	1003	555	1309	1864

* Data represent averages of 1 square yard sample from each of three replications in a randomized block experiment."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Mr. Dreibelbis reports frost penetration to a depth of 5 inches in wheatland. Air and soil temperatures on the day of maximum frost penetration are given in the following table. Similar data are given for a wooded area for contrast.

Table 1.--Contrast in soil and air temperatures on December 16 and December 22, 1949. °F

	Watershed 109 (wheat) Muskingum silt loam			
	Temp. December 16		Temp. December 22	
	Max.	Min.	Max.	Min.
30-inch canopy	32	8	62	32
2-inch canopy	26	15	54	34
1/2-inch soil	26	23	44	40
3-inch soil	32	30	44	40
12-inch soil	40	40	41	41
24-inch soil	39	38	41	40
	Watershed 131		Woodland, Muskingum loam	
	Max.	Min.	Max.	Min.
30-inch canopy	18	16	48	32
2-inch canopy	28	17	49	34
1/2-inch soil	36	34	41	46
3-inch soil	38	36	48	45
12-inch soil	52	42	53	52
24-inch soil	50	49	54	53

"R. E. Youker, engaged in soil-moisture observations and compilations, reports that hydrologically it may be desirable to present observed soil-moisture data in terms of 'percent of saturation.' Most data of this type have, in the past, been given as percent by weight.

"Soil-moisture content is sometimes expressed on a percent by volume basis. A soil-moisture content of 35 percent by volume for the various layers of a soil does not directly indicate the relative moisture content of each of the layers nor how near the values are to saturation. Actually, a value of 35 percent by volume represents soil-moisture contents of 68.6 percent, 72.9 percent, and 100 percent of saturation for the 0-7, 7-16, 16-30-inch layers of Muskingum silt loam, respectively, a shown in table 2 on the next page.

"Although the air space is also shown in table 2, this would not be necessary to include in the table as it is simply the difference between the moisture percent of saturation and 100 percent.

"It would seem desirable to express saturation as 100 percent for all soils as well as for each of the layers of a specific soil such as Muskingum silt loam. This would permit direct relative comparisons of the moisture contents and air space of the various layers of a given soil or various soils as borne out in table 3 which appears on next page.

Table 3.--Soil moisture for different sections of the profile of Muskingum and Keene Silt Loam Soils in units of percent by volume and percent of saturation

Soil	Depth	Tension (CM.) 0	30		40		60		100		500		
		Saturation percent by volume	Percent by Vol. Water	Percent of saturation Water	Percent by Vol. Air	Percent by Vol. Water	Percent of saturation Water	Percent by Vol. Air	Percent by Vol. Water	Percent of saturation Water	Percent by Vol. Air	Percent by Vol. Water	Percent of saturation Water	Percent by vol. Air	Percent by vol. Water	Percent of saturation Water	Percent by vol. Air
Muskingum Silt Loam	0-7"	51.0	37.4	73.3	26.7	36.1	70.8	29.2	34.6	67.8	32.2	32.8	64.3	35.7	29.0	56.9	43.1
	7-16"	48.0	40.3	84.0	16.0	39.0	81.3	18.7	37.0	77.1	22.9	34.5	71.9	28.1	31.0	64.6	35.4
	16-30"	35.0	31.0	88.6	11.4	30.0	85.7	14.3	28.4	81.1	18.9	26.8	76.6	23.4	*26.0	74.3	25.7
Keene Silt Loam	0-7"	51.0	42.8	83.9	16.1	41.1	80.6	19.4	38.7	75.9	24.1	36.4	71.4	28.6	31.0	60.8	39.2
	7-14"	50.0	42.6	85.2	14.8	41.9	83.8	16.2	41.1	82.2	17.8	40.0	80.0	20.0	36.0	72.0	28.0
	14-24"	44.0	41.3	93.9	6.1	41.0	93.2	6.8	40.6	92.3	7.7	39.8	90.5	9.5	39.6	90.0	10.0

*Estimate

"Such an approach would permit the preparation of tables grouping soils on a percent by volume basis converted to a percent of saturation basis. For example, for all soil layers whose saturation value is 51 percent by volume, one table could be used to convert soil-moisture data in 'percent by volume' to values in 'percent of saturation.' Such a table would be somewhat like that shown in table 4.

Table 2.--Muskingum silt loam

Soil moisture percent by volume	Percent of saturation at depths					
	0-7"		7-16"		16-30"	
	Water	Air	Water	Air	Water	Air
Percent						
35	68.6	31.4	72.9	27.1	100	0
25	49.0	51.0	52.1	47.9	71.4	28.6
15	29.4	70.6	31.3	68.7	42.9	57.1

Table 4.--Soil layers saturated at 51 percent by volume

Percent by volume	Percent of saturation	Saturation deficiency
51	100	0
49	96.1	3.9
47	92.2	7.8
45	88.2	11.8
43	84.3	15.7
41	80.4	19.6
1/ 39	76.5	23.5
37	72.5	27.5
2/ 35	68.6	31.4
33	64.7	35.3
31	60.8	39.2
29	56.9	43.1
27	52.9	47.1
Etc.	Etc.	Etc.

1/Approximate division between capillary and non-capillary pores for Keene silt loam, 0-7-inch depth.

2/Approximate division between capillary and non-capillary pores for Muskingum silt loam, 0-7-inch depth.

"Tables could be prepared on a 100 percent saturation basis representing 50 percent by volume, 49 percent by volume and so on to cover the entire range of soil-moisture contents for all soil layers.

"Such information is essential in hydrologic computations of soil-water movements and relationships between soil-water movements and infiltration and surface runoff. Comments are invited."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"Oats and Madrid sweet clover planted in October have made good growth and are furnishing grazing for the cattle during favorable weather. A noticeable difference is showing up in color and growth between oats following grain sorghum and oats following corn. The oats following grain sorghum are a darker green in color, indicating more available nitrogen. The grain sorghum land was plowed a month earlier than the corn land. The oats were seeded on the same date. A satisfactory stand of Madrid clover was obtained with 6 pounds of seed per acre seeded at the same time the oats were drilled with a combination type grain drill.

"A 3-year cropping system of cotton, corn, and oats with Hubam clover as a soil improving crop increased the corn yield of 11.2 bushels per acre on a 7.1-acre field. The corn yield was 43.05 bushels per acre. A comparable field of 7.3 acres without contour cultivation and terraces with the same crops in the cropping system without Hubam clover in a 4-year rotation of cotton, oats, cotton, and corn with straight-row farming produced only 32.05 bushels per acre. This represents a 35 percent increase in corn yield resulting from contour cultivation, terracing, and a soil improving crop in the system."

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"Contoured corn continued to show about a 5-bushel advantage over straight row corn on the small watersheds with subtilled corn showing only a slightly higher yield than the straight row. On July 9, a hail storm cut through the northwestern part of the Government leased land, resulting in more damage to two of the subtilled watersheds than to the others. Following is a table showing the 1949 corn yields:"

Average Corn Yields - 4-acre Watersheds - 1949

Straight Row	28.4 Bu/acre
Contoured	33.6 " "
Subtilled	28.5 " "

Hydrologic Studies - R. B. Hickok, LaFayette, Indiana.-"Mr. E. R. Baugh of the Experiment Station has reported this year's results from the mulch tillage plots and the following has been taken from his report. There are 240 plots in this experiment of which 64 were in corn this year. Yields for the eight treatments at each location are given in table 1. The fertilization rates are given in table 2. Both tables appear on the next page.

"This year for the first time yields from all plots from the Noble County Farm exceeded those from the Throckmorton Farm. Yields were considerably above normal at the Noble County Farm and below normal at the Throckmorton Farm.

"The dominant reason for this striking difference is indicated by the rainfall records. During the critical period from August 7 to September 17 the Noble County Farm received 2.5 inches more rain than the Throckmorton Farm and it was well distributed. At the Throckmorton Farm, the rainfall deficiency during August and September totaled 4 inches. Other factors which probably contributed to the low yields at the Throckmorton Farm are lower natural fertility of this series of plots and considerable weed competition which developed due to our inability to cultivate at the proper time.

Table 1.--1949 corn yields, Purdue-Throckmorton Farm and Noble County Farm

Treatment No.	Residue Location	Depth of tillage in inches	Implements used	Throckmorton Farm[1]	Noble County Farm[2]
1	Surface	6 Strip only	Lister bottom & spring tooth field cultivator (Strip only)	64	99
2	Surface	3	Sweeps	64	78
3	Surface	3 & 7	Sweeps	59	76
4	Mixed 0-3"	3	Disc harrow	73	86
5	Mixed 0-3"	7	Special plow & Disc harrow	72	103
6	Mixed 0-6"	6	Cover crop disc[3]	79	79
7	Under 4-7"	7	Moldboard plow	76	108
8	Mixed 0-3"	7	Plow 1-1/2" in fall, spring same as No. 5	84	98

[1]L. S. D. 5 percent Noble County Treatment - 17.4
[2]L. S. D. 5 percent Throckmorton Farm - 14.5
[3]Plowed 3 inches before cover crop disc was used.

Table 2.--Fertilizer application for 1949 corn on mulch tillage plots

Purdue-Throckmorton Farm				Noble County Farm			
Time of application	Position	Rate #/A.	Analysis	Time of application	Position	Rate #/A.	Analysis
Fall	Bands 8" deep and 24"apart	700	8-8-8	Fall	Bands 8" deep and 24"apart	700	8-8-8
Fall	Broadcast	300	3-12-12	Fall	Broadcast	300	8-8-8
Planting	In row	200	3-12-12	Planting	In row	200	8-8-8

"The weather conditions in Noble County favored yields with the moldboard plow, however, some of the mixed residue methods approached the plow method. Erosion was serious on the plowed plots. When considered over the 5 years of the experiment, treatment No. 5 has furnished yields equal to those using the moldboard plow and has furnished good protection against erosion. We feel that we can recommend this practice on the hummocky lands of northern Indiana.

"Two new practices (No. 1 and No. 8) were favorable at the Noble County location while No. 8 gave the top yield at the Throckmorton Farm.

"Pilot tests were continued on additional plots at both locations using the spring tooth field cultivator for seedbed preparation. A field trial using this method on watershed No. 13 was reported in our October monthly report. Fertilization was the same as that on the main experiment at both locations. Yields from four

replicates on the Throckmorton Farm and three from the Noble County Farm are given in table 3. The fall, shallow tillage (treatment A) resulted in favorable yields at the Throckmorton Farm.

Table 3.--1949 corn yields using the spring tooth field cultivator

Treatment	Noble County		Throckmorton	
	Stalks/A	Yield Bu/A[1]	Stalks/A	Yield Bu/A[1]
A Fall tilled 2.5 - 3 inches deep Field cultivator in spring 7" deep & disc			13,800	92
B Field cultivator in spring 7" deep & disc	9,600	87	12,100	85
C Moldboard plow in spring 7" deep & disc	12,500	104	13,400	93

[1]At 17.5 percent moisture

"All yields from these plot studies are affected by two dominant factors, i. e., physical soil conditions which influence the stand and growth factors of corn such as soil moisture, aeration, and fertility. To properly evaluate any practice we should attempt to separate these factors. The influence of a treatment on the growth factors can only be evaluated if the plant population is constant. The stands, however, have been higher using the moldboard plow than by any other tillage method which complicates this evaluation. If the stand on some of the mulch treatments was equal to the stand obtained using the moldboard plow, the yield under the mulch tillage system would be higher. The effect of stand should be eliminated, which indicates that certain treatments should be abandoned or modified in a manner to secure and maintain an adequate stand. Hand planting does not seem to solve the problem. In 1948, the plots were hand planted and the variation in stand still existed. Thus, it must be concluded that the machinery used does not prepare the seedbed for best germination and establishment of the plants."

East Lansing, Mich.

Hydrologic Studies - Geo. A. Crabb, Jr.--"Precipitation for the month of December as measured by the U. S. Weather Bureau standard nonrecording rain gage amounted to 4.29 inches at the cultivated watersheds, and 4.03 inches at the stubble-mulch plots. These amounts are approximately 207 percent, 227 percent, and 195 percent of the 50-year average December precipitation of 2.07 inches. December precipitation can be expected to equal or exceed 4.29 inches once in 25 years. Cumulative rainfall for the year amounts to 34.33 inches or 109 percent of the 31.43-inch normal. Annual precipitation can be expected to equal or exceed 34.33 inches once every 4 years. There was one runoff during the month from watershed 'B.'

"Conferences in regard to the publication of the Project's technical bulletin 'Solar Radiation Investigations at East Lansing' were continued with Experiment Station personnel. It was decided to publish this bulletin, including the bibliography, with local verification of the numerous references appended. This is in agreement with both Director Hardin's and Chief of Research Nichols' viewpoint."

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"At Edwardsville the precipitation was 4.52 inches as compared with a normal of 2.20 inches. All this precipitation was in the form of rain, and at moderate intensities, yet the runoff totaled 1.57 inches. Temperatures varied from a maximum of 68 degrees on the 11th to a minimum of 10 degrees on the 15th with the mean for the month being slightly above normal. Soil temperature records were discontinued. During the winter months the records collected will consist of two rain gages, three runoff stations, and the temperature and humidity.

"Precipitation at Fennimore totaled 1.51 inches as compared with the normal of 1.20. 0.83 inch of this amount occurred as rain on the 11th, yet the total runoff was only 0.03 inch, although it appears that the ground was probably frozen since temperatures were below 30 degrees for most of the previous 10 days. The amount of water going into the soil is without doubt due to the dry condition of the surface at the time of the freeze-up."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-"A few days were spent in designing models for insertion in the portable demonstration channel. These models will illustrate the performance of several different types of overfall structures and their stilling basins as well as the performance of pipe drop inlet spillways and stilling basins therefor. For example, stilling basins for the pipe drop inlet spillway will be made for the hydraulic jump type of basin, the Bureau of Reclamation rectangular basin, and the SAF stilling basin. The lengths of these three basins are respectively, 16 inches, 10 inches, and 5 inches. They will demonstrate a great saving in material can be achieved by proper design. Five different types of entrances to the pipe drop inlet spillway will be built to show the effect of re-entrant entrances, square-edged entrances, round-edged entrances, and the drop inlet entrances."

Supplemental Irrigation Studies - T. W. Edminster, Blacksburg, Virginia.-"The Plant Pathology Department has recently completed the sorting and stripping of the burley tobacco produced on the irrigation experiment. The tobacco grown on the irrigated plots proved to be much better quality than that produced on the non-irrigated plots. The degree of this improvement will be known early in January when the tobacco is placed on the market for sale. The difference in quality is of particular interest since during the growing season it was impossible to detect any apparent difference in the growth characteristics or the quality of the tobacco on the irrigated and non-irrigated plots. The entire difference first became evident during the curing process."

Drainage Studies - E. G. Diseker, Raleigh, North Carolina.-"As previously stated, samples of plants which were causing excessive sedimentation and impounding of water in the McRae Canal, were brought to N. C. State College for identification. Additional samples were brought in to replace those which were previously misplaced. The identification of the four plants causing most of the damage are listed in the order of importance, as follows:

1. Bur-Reed (Sparganium). This plant resembles a lilly and has leaves about 5/8 of an inch wide and about 18 inches long. It thrives underneath water during the winter; most of the blades above water are killed by heavy frosts. Due to its thick, upright growth, it is the worst of the plants in the canal for impounding the water.

2. False Loose (Strife Ludwigila Palustris). This plant has leaves about 1 inch in diameter, which vary in color from green to purplish red. It is bunchie and of a prostrate nature. It is the worst offender found in this canal for causing soil deposits.

3. Pennywort - (Hydrocotyle Umbellata). This is a semiprostrate plant and the leaves vary from 1-1/2 to 2 inches in diameter and are smooth and shiny. It is not very prevalent and does not cause too much damage.

4. Rush (uncus Effusus). This is an upright plant which grows in bunches or clusters. There is possibly one or two dozen blades per plant. The blades or stems do not have joints or nodes, and are round--about 1/8 inch in diameter, and about 18 inches long. They are smooth, dark green, and needle-pointed at the top. This plant, thus far, has not caused serious trouble because of its sparse stand, and because it tends to grow best on the high places and sand bars in the canal bottom when the water flow is at a minimum. There is possibly more of it growing on the canal bank than there is in the canal bottom."

Drainage Studies - J. C. Stephens, West Palm Beach, Fla.-"During the first part of the month of December rainfall was low over the Everglades area. However, during the last part of the month, rainfall was unusually heavy for this season of the year. The rains continued into the first week of January and crop damage was heavy due to both the heavy rainfall and the accompanying squally winds which reached velocities of 35 to 40 miles an hour in some sections. Rainfall appeared to be heaviest along the coastal area from Ft. Lauderdale (where 13 inches was recorded in a period of about 1 week) north through West Palm Beach; however, heavy rains also occurred at Belle Glade and around Lake Okeechobee. The vicinity around Miami received the least rainfall in the area.

"At the Everglades Experiment Station 7.09 inches of rain was recorded which is the maximum amount on record for December since records began in 1924. The previous maximum was approximately 6.5 inches and the average rainfall for this station for December is approximately 1.4 inches.

"Some work was done on the line project 'Control of Underwater Aquatic Plant Growths in Drainage Canals.' A 1,000-foot stretch of lateral canal at Osborne's Grove previously selected for test purposes was cross sectioned and a stage volume curve prepared in order to determine rate of dosage application in p. p. m. for amount of water in the ditch. A test run was made on the spray rig design and constructed at the Experiment Station for the purpose of applying the chemical treatment to the underwater mosses. This test showed that several changes could be made that would probably prove helpful in obtaining better mixing of the spray emulsions at the bottom of the infested ditch. Since the specific gravity of the emulsion is less than water and tends to rise to the surface, one of the major design problems appears to be how to obtain application of the napthas in sufficient amounts near the bottom of the channel to obtain plant kills. These changes are now under way. An examination of the other test stretch at Osborne's Grove showed that the bench marks used to determine slopes in the flow tests on the value of 'n' had been disturbed since the last measurement. Levels were rerun over the course eight times and relative elevations re-established with a probable error of plus or minus 0.00076 foot.

"Due to the interest of cooperating districts, ground-water studies were largely directed toward determining the amount of seepage loss to be expected in the proposed conservation areas in Dade and Broward Counties, and the effect on adjacent agricultural land.

"The amount of seepage into a diked and drained agricultural tract of 800 acres in Broward County adjacent to the originally proposed conservation area was determined for a 30-day period in late 1948 and early 1949. Water was pooled over the surface of the proposed reservoir at the time. The data showed a large seepage inflow amounting to an average equivalent rainfall of 0.8 inch each day during the 30-day period. Total inflow was combined seepage from water standing immediately behind the ring dikes and piezometric flow from the pooled area which underflowed both the New River Canal and the ring drainage ditches. The proportion from each source to the total inseepage was not determined. Profiles of the ground water indicate that seepage from the pool was effectual for a distance of about 1/4 to 1/2 mile below its source. This suggests the desirability of a 'buffer strip' adjacent to the levees around proposed conservation pools where similar subsurface conditions occur. As a result of this study, relocation of L-35 in the Federal Flood Control Project was made, upon request of the District and local interests, at an estimated savings of over three-quarters of a million dollars.

"A modified Slichter test was conducted to investigate techniques for making direct field velocity measurements of ground water at the Dade-Broward levee in cooperation with the Central and Southern Florida Flood Control District and the Dade County Engineer's Office. Procedure was to time the flow of an electrolyte passing between two uncased wells, 60 feet deep, on opposite sides of the levee. It was impossible to obtain a precise ascertainment of the average velocity and the average effective porosity because of the cavernous nature of the limestone aquifer; however, using a rather wide range in computing the permeability the test showed the magnitude of seepage was considerable. The coefficient of permeability ranged from 161,000 to 403,000 g. p. d. The test also revealed that the flow of water through the aquifer was controlled by local piezometric pressure rather than the slope of the phreatic seepage line through the levee.

"These seepage studies, together with data secured from the U. S. Geological Survey indicated that seepage losses in the proposed Dade-Broward conservation area would be of considerable magnitude and possibly in amounts that would be excessive for successful water storage at the contemplated pool heights, and that adjacent lands might suffer from waterlogging unless protected."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Little or no rain was recorded to December 8 when a light shower occurred in the central and lower part of the area. Then no rain was recorded until December 17. From this date to the end of the period we had light showers practically every day to December 30. Total rainfall for the period varied from 0.73 to 2.20 inches.

"Moisture readings in our mulch plots to December 17 increased. For the period December 17 to December 31 with light frequent showers we had a steady decrease in the reading. During this same period there has been a steady increase in nitrate nitrogen for the pine straw and grass mulch areas with no increase for the natural cover, shavings or check plots. Nitrates are run principally to determine the rate of breakdown of the various mulching materials.

"Analysis of chloride samples collected from our lines in the Homestead area in general show no increase in concentration except for the area in the Military Canal from the structure west to Allapatta Road. There has been a definite increase in concentration in this area. The concentration at one point has increased from 730 p. p. m. to 3,550 p. p. m. Indications are that this increase is caused by pumping from deep rock ditches. This removes the fresh water head and allows the salt wedge to move upward.

"During this period, in connection with our Highland Water-Control Plot, we have continued to clear our ditches of water so that should a heavy rain occur we would have room to take care of our water. To do this the small pump of 2,000 g. p. m. is started every third day and run for 6 - 8 hours at about half speed. Areas where the ditches penetrate the rock are still being pumped continuously to hold the water. On all new ditching in this area the marl seal type of ditch is being used. At the present time this type of ditch is being used on approximately 640 acres of land.

"At the present time we are designing a measuring basin so that we can make actual measurements of the amounts of water pumped and also carry on some pumping tests at different heads."

DIVISION OF IRRIGATION AND WATER CONSERVATION

Irrigation Studies - Karl Harris, Phoenix, Arizona.-"Lettuce irrigation studies were concluded on the farms of John Jacobs at Deer Valley. The soil type is a Mohave Loam. It was determined that for this field, planted to lettuce on September 5, 1949, it took 5.07 acre-feet of water per acre to make the lettuce crop. Of this amount 44 percent went off as waste. A yield figure for this field is not available because part of the lettuce was plowed under due to a drop in the market price. The measured figure of 5.07 acre-feet per acre was about 2 acre-feet more than the amount the farmer thought he used.

"The differential irrigation tests were continued at the University of Arizona Vegetable Farm. To date, 28-1/2 acre-inches have been applied to the high treatment, 23-1/2 acre-inches to the medium treatment, and 19 acre-inches to the low treatment. Yield results will not be available until the first part of February."

Irrigation Studies - E. G. Hanson, State College, New Mexico.-"During this month, soil samples for volume weights and permeability measurements were obtained from pits located near sites where moisture depletion studies were made last cropping season. The samples were obtained with the Uhland soil sampler which appears to give good results. Previously, the soil tube had been used in sampling for volume weights but the results were too erratic to be used in calculations for moisture depletion. Part of the difficulty in determining volume weights with the soil tube in this area has been incurred by the presence of sand which is located under this area below depths ranging from 15 inches to 36 inches.

"The work this month, other than the pit studies and volume weight sampling, has consisted mainly of plotting the moisture depletion data and of using the "Uhland sampler" volume weights to calculate the data for inclusion in the 1949 calendar year report.

Irrigation Studies - W. R. Meyer, Garden City, Kansas.-"Below is a chart that shows the total amount of irrigation water during the season--which consisted of five irrigations and the average time of application for one irrigation.

Table 1.--Total amount of irrigation water applied during Season in acre-inches

Rate	Length of run in feet				
	300'	500'	800'	1,000'	1,300'
5 gal/min.	12.32	15.34	17.54		
10 " "	16.42	17.54	19.41	23.88	26.78
20 " "	14.86	21.90	18.32	31.08	32.50
28 " "				28.41	32.28

Table 2.--Average time in hours and minutes for one application

Rate	Length of run in feet				
	300'	500'	800'	1,000'	1,300'
5 gal/min	2:31	4:35	10:26		
10 " "	1:35	2:50	6:38	9:47	15:27
20 " "	:48	1:55	3:31	6:38	9:06
30 " "				3:21	5:28

Water Spreading for Recharge of Underground Basins - A. T. Mitchelson, Dean C. Muckel, E. S. Bliss, Curtis E. Johnson, Berkeley, Calif.-San Joaquin Valley--"During the month of December additional percolation experiments were carried on. Percolation tubes used in a previous test to determine the effect of variations in packing methods were sorted into groups of 6 tubes. Each group had approximately equal average percolation rates. The first group received an application of redwood sawdust equal to 10 tons per acre. The second received no treatment and served as a control. These two groups were supplied with tap water. The third group of tubes was supplied with a 1 percent solution of 'Renex,' a calcium base detergent, in tap water. The 'Renex' was obtained from Atlas Powder Company. The percolation rate on all groups has been decreasing during the month. The 'Renex' group, however, has shown a very sharp decline to about a tenth of the rate of the control group. The sawdust group has dropped slightly below the control but is not significantly different.

"At present there is a flocculent precipitate on the surface of the soil in the tubes receiving the 'Renex' solution. Microscopic examination of this material revealed that it was composed of large numbers of bacteria. A large, gram negative, rod-shaped organism predominates. These organisms appear to be surrounded by a gelatinous mass which may account for the rapid sealing of the tubes containing 'Renex.' On future experiments microscopic examination of the water in the tubes will be made at frequent intervals in an effort to determine if the presence of the organism noted is correlated with the sharp drop in percolation rate.

"As a result of testing various kinds of culture media, the sodium albuminate agar has been adopted for use in this laboratory in determining total counts of bacteria and actinomycetes.

"Samples were collected from the 0-1-inch depth of Wasco ponds 10 and 11 for total counts. Pond 10 had an application of cotton-gin trash spaced into the soil in May 1948. Pond 11 was untreated. The pond treated with gin trash contained 969 million organisms per gram of soil and the untreated pond contained 202 million organisms per gram of soil. This indicates the far greater activity of the pond containing additional organic material. These ponds have now been started and total counts will be made from time to time during operation.

"In an attempt to study the shape of the 'cone' of water descending from a pond to the underlying water table, a series of 20-foot deep holes have been drilled radiating from the two sets of concentric ponds. Moisture samples have been taken from each foot depth in all holes and an attempt will be made to secure samples from the same holes at varying intervals of time after these ponds have started.

"A complete analysis of the water used in the Bakersfield laboratory was made by the Rubidoux Laboratory at Riverside at our request. Fortunately, the water was found to be very similar to Kern River water and synthetic mixtures will not have to be used as was necessary in earlier percolation tests made at Riverside. The laboratory supply analyzes more nearly like Kern River water than either the well supplying the Wasco field ponds or the well supplying the Minter Field ponds. The quality of water at the Madera plot and which is indicative of that to be delivered through the Friant-Kern Canal of the Central Valley Project, is characterized by low total salts. The conductivity ($K \times 10^6$ at 25 deg. C.) is 55 as compared to 190 for our laboratory water. Sodium percentages are about equal at 40 and the hardness expressed as calcium carbonate is 62 for the laboratory water as compared with a hardness of 20 for Friant-Kern water.

"Because there has been so much delay in starting the two 6-acre experimental spreading plots near Visalia, the North Kern Water Storage District has started application of cotton-gin trash to one of its 5-acre spreading basins to test out practical use of gin trash as a means of stimulating infiltration and percolation to ground-water basins. Adjoining the treated plot, there will be an untreated plot of somewhat similar size which will be operated as a test. It will be interesting to compare the results obtained from the larger plots with those we have found on the smaller ponds at Minter Field and Wasco.

West Coast Basin Investigation--H. F. Blaney, Los Angeles, California.- "In connection with the water conservation study being made in the West Coast Basin of Los Angeles County, in cooperation with the California State Division of Water Resources, monthly consumptive use and temperature as follows:

Month	Mean monthly temperatures (t)	Daytime hours (p)	Consumptive use factor (f)	Measured consumptive use (u)	Consumptive use coefficient (k)
	°F.	Percent		Inches	
January	54.9	7.10	3.898	1.13	0.29
February	54.8	6.91	3.787	1.32	.35
March	58.5	8.36	4.891	2.62	.54
April	60.6	8.80	5.331	3.92	.74
May	65.9	9.72	6.405	4.64	.72
June	67.0	9.70	6.499	4.77	.73
July	72.2	9.88	7.133	6.84	.96
August	71.7	9.33	6.690	5.74	.86
September	68.9	8.36	5.760	4.18	.73
October	66.3	7.90	5.238	3.86	.74
November	61.8	7.02	4.338	2.34	.54
December	58.8	6.92	4.069	1.59	.39

$$k = \frac{u}{f} = \frac{\text{measured monthly consumptive use}}{\text{consumptive use factor}} = \text{monthly coefficient.}$$ "

"A preliminary report on this project was completed by V. S. Aronovici, Marvin Litz, and William W. Donnan during the month of December.

Imperial Valley Investigations - George B. Bradshaw, Imperial, California.-"The third run, on a 140-acre test plot of an alternately wetting and drying leaching study has been completed. The test plot is tiled at a 337-foot grid spacing. The soils range from medium to heavy textured and were very saline to a depth of 5 or 6 feet. A series of soil samples at various locations in the tract showed a salinity ranging from 30 to 102 tons of salt per acre-foot in the surface foot of soil.

"The results of the three runs are given in the table on the next page.

	1st run	2nd run	3rd run
Duration of leaching in days	30	44	74
Acre-feet of water applied	188.4	393.9	826.8
Tons of salt applied in the water	243.0	492.8	1,254.0
Acre-feet of water surface wasted	63.0	223.7	553.1
Tons of salt in surface waste	380.0	852.4	1,575.5
Acre-feet of water from tile system	14.1	13.8	24.6
Tons of salt from tile system	857.8	863.8	1,287.7
Acre-feet of evaporation	103.0	147.3	229.1
Acre-feet estimated to deep seepage	8.0	9.0	20.0
Tons of salt, per acre, removed from the test plot	7.1	8.7	11.5

"The salinity of the drainage effluent has decreased from 63 tons per acre-foot at the beginning of the study to 53 tons at the end of the third run. The soil salinity for the test plot has also decreased about 50 percent in the first and second surface foot of soil. It is estimated that one or two more leaching runs will be required to reclaim the land sufficiently for crop production."

San Fernando Valley Investigation - W. W. Donnan, Los Angeles, California.-"An inventory of pumping from the underground basin of the San Fernando Valley has been completed. Data from the Department of Water and Power, City of Los Angeles, and from other local sources have been used to compile a tabulation of pumping for the years 1926 to 1948. These data reveal that the extractions of water from the basin have been increasing and have become an important source of water for the various urban communities of the valley. In addition to the extractions by pumping, the City of Los Angeles develops about 100,000 acre-feet of water each year at the Narrows outlet infiltration galleries. Thus, the total yearly yield of water from the underground basin at the present time aggregates about 225,000 acre-feet. This factor presents one more angle to the drainage problem of the San Fernando Valley. Namely, the problem of lowering the water table and at the same time attempting to maintain as large a reservoir supply in the underground basin as is possible."

San Fernando Valley Investigation - G. M. Litz, Los Angeles, California. "The monthly readings of the piezometer well grid system in the high water-table area of San Fernando Valley for the year 1949 were analyzed and a depth to water table map was prepared for the month of March, when the water table was highest, and one for November, when it had receded to the lowest point of the year. A comparison of the two maps show a general recession of the water table of only 3 feet, with a lesser drop of 2 feet at the two local areas of highest water table, one at the intersection of Sherman Way and De Soto Streets, and the other at the intersection of Chase and Van Alden Streets. Both areas are adjacent to abandoned wells known to be artesian. The maps indicate that these wells are one of the factors maintaining the water table at an elevation so near the ground surface that it will be influenced by an average storm during the winter months. The piezometer readings of December are an indication of this influence. Piezometers with a 4-foot depth to water showed a rise of five tenths of a foot as a result of a 2-inch rain on November 10, and another 2-inch rain on December 8, while piezometers in areas with an 8- to 10-foot depth to water showed a rise of from 1 to 3 tenths of a foot, with some remaining the same."

R-3-2-1 #1 Friction Losses in Pipes and Fittings - C. Rohwer, Ft. Collins, Colorado.-"A revised copy of the report on Friction Losses in Selected Valves and Fittings for Irrigation Pumping Plants was submitted to Director Henney of the Colorado Agricultural Experiment Station. He approved it for publication by the Station. Although about $400 in funds from other sources is available it will probably be necessary to print this bulletin with the understanding that all copies will be sold in order to defray the cost of publication.

R-3-1-2 Seepage Losses from Irrigation Channels - C. Rohwer, Ft. Collins, Colorado.- "During November tests of the losses from the seepage rings for heads ranging from 24 inches down to 2 inches were made at the College. During December a series of tests was completed for heads ranging from 2 inches up to 24 inches. By this expedient it was hoped that the effect of time and the direction in which the changes of level were made would be eliminated from the readings. However, preliminary plottings of the data indicate that time is the most important factor.

"Tests of the permeameter developed by the Division of Irrigation were continued. This device is relatively easy to operate but requires careful attention to details. Recent tests have shown fairly consistent results and reasonable agreement with the seepage ring measurements. Difficulty has been encountered in operating the permeameter designed by the Bureau of Reclamation. This device operates under a partial vacuum and it was discovered that part of the trouble in controlling the level of the water in the test hole was caused by small air leaks. When these were sealed more consistent results were obtained. The data obtained are now being analyzed.

Sprinkler and Surface Irrigation Studies - W. D. Criddle, Boise, Idaho.- "During the month a progress report on the results of the 1949 studies in the Black Canyon area of Idaho was prepared and mimeographed. Copies were sent to each of the cooperating and interested agencies.

"Details were completed for a meeting between cooperators on January 19 and 20 at which time 1949 studies will be reviewed and plans made for the 1950 program.

"Mr. Pair completed a draft of a proposed U. S. Dept. of Agriculture leaflet entitled, 'Should I irrigate by Sprinkling.'

Water Requirement Studies - W. D. Criddle, Boise, Idaho.-"During the month a final draft of a proposed U. S. Dept. of Agr. technical paper entitled, 'Determining Water Requirements in Irrigated Areas from Climatological and Irrigation Data,' was prepared by Blaney and Criddle. This is a revision of an earlier paper on the same method, which since its release in 1945 has been used rather widely throughout the West for estimating water requirements."

Irrigation Studies - C. E. Houston, Reno, Nevada.-"A rough draft of a report 'Consumptive Use and Irrigation Requirements of Crops in Nevada' have been completed and will be submitted for review in January. Tentative plans call for publication as a Nevada Agricultural Experiment Station bulletin.

"Material developed in this report, from the Blaney - Criddle formula, show the extreme conditions incident to irrigation in Nevada. In the northeastern part of the State official Weather Bureau growing seasons are less than 3 months and consumptive use of water for alfalfa is about 14 inches. In the extreme southern end of Nevada official growing seasons are more than 300 days and consumptive

use of water by alfalfa is about 56 inches. Rainfall is a minor contribution to consumptive use ranging from about 1 inch in the shorter growing period area to about 3.5 inches in the longer area."

Cooperative Irrigation Studies at the Texas Agr. Expt. Substation, Lubbock, Tex. - M. P. Swanson, Amarillo, Texas.-"Volume weights of station soils were obtained with an undisturbed core sampler. Volume weights of sandy loams averaged 1.55 near the surface and 1.40 at depths of 18 to 30 inches. Volume weights on sandy soils average 1.80 near the surface to 1.63 at depths of 18 to 30 inches.

"A reasonably close range of water requirements was obtained for grain sorghums on the experiment station plots and the cooperative irrigation field studies, with the exception of the field study at Tahoka, Texas. See table on next page. Losses from deep percolation on the Tahoka field were almost unavoidable due to heavy rainfall.

Velocity Measurements of Small Streams - S. J. Mech, Prosser, Wash.- "The month of December was devoted to the continuation of routine computations. Computation of the field data must necessarily precede any tabulation and analysis.

"Velocity measurements on streams in the irrigation furrows has developed some interesting results. Classic experiments on stream velocities usually cover only streams far greater than those found in the irrigation furrows. There is not much information for such small flows.

"The following table shows the season average velocities for three stream sizes on 18 plots irrigated in furrow with a grade of 7 percent and 18 in furrow grade of 2 percent.

Nominal application rate	1948 potatoes		1949 Sugar Beets	
	2% furrow grade	7% furrow grade	2% furrow grade	7% furrow grade
	Ft/Min.	Ft/Min.	Ft/Min.	Ft/Min.
q	54.1	55.9	31.3	35.9
2q	65.8	63.8	43.6	51.1
3q	86.2	85.0	49.8	66.7

"Velocity measurements on beets were based on the interval between the time water was turned off and the time this drop in head was reflected on the runoff chart. By synchronizing the application and runoff recorder clocks the measurements were accurate with 1/2 minute.

"The variability of the hydraulic characteristics of the furrow channel is well illustrated by the changes in the velocity that takes place as the season advances and vegetative canopy increases. On 2 percent furrow grade the average velocity for 18 sugar beet plots was 69.4 feet per minute on April 18. It rose to 80.6 on May 16 following reditching on May 14, and then dropped along a practically straight line until on October 1 it was only 19.4 feet per minute.

"The 18 plots with a 7 percent furrow grade gave strikingly similar results. The velocity on April 18 was 88.6 feet per minute. On May 18 it was 83.3 following the May 14 reditching. It dropped along a practically straight line until it reached 48.1 on July 24 and 31.2 on October 3.

Table 1.--Water requirements for grain sorghums under irrigation on the High Plains of Texas--1949

Location	Method of irrigation	Irrigation No. of applications	Depth of water applied (Inches	Rainfall planting to harvest (Inches)	Soil moisture difference at planting and harvest (In.)	Total water use (Inches)	Yield in lbs. per acre (grain)
Floyd S.C.D. Floydada, Texas	Furrow	3	9.74	6.57	-0.19	16.50	3,687
Hale S. C. D. Plainview, Texas	Furrow	2	6.5	10.75	Negligible	17.25	3,150
Lynn S.C.D. Tahoka, Texas	Level borders	2	10.0	16.83	-0.60	27.43	3,184
Deaf Smith W.E.D. Hereford, Tex.	Furrow	2	8.03	8.20	-3.63	19.86	5,136
Amarillo Conservation Experiment Station Irrigation Treatment Plots							
"A" Plots	Level border	1*	2.54	8.56	-3.09	14.19	2,445
"B"&"C" Plots	Level border	2*	6.54	8.56	-2.09	17.19	2,967
Drilled vs Listed Plots (Early Hegari)							
Drilled plots	Level border	2	6.72	8.56	-0.10	15.40	4,010 (5,053**)
Listed plots	Level furrows (with borders)	2	7.12	8.56	-2.35	18.33	3,169 (3,395**)

*All of these plots are given a 2.5-inch irrigation a week after planting to soften the hard surface crust which resulted after a high intensity rain on the day of planting.

**Actual yields on the plots on which the soil-moisture data were taken.

"That this drop in velocity is due to the interference of beet leaves with the flow of water is suggested by those results and substantiated by field observations. With 24-inch row spacings the lower leaves reached the water in the furrow early in the season.

"Results for 1948 potatoes show similar velocity reductions as plants approach the stage where their tops cover the 36-inch spacing between rows. The wider spacing tended to delay the beginning of this velocity drop. The 2 percent furrow grade showed a velocity of 72.5 feet per minute on June 17, increasing to 78.1 on August 1, and then dropping gradually until it reached 58.1 on September 15.

"The 18 plots with 7 percent furrow grades had a velocity of 69.4 on June 17, rising to 78.1 on August 1, and then dropping along a practically straight line until on September 17 it was only 53.2 feet per minute.

"The preceding data are results from 150 plot measurements on potatoes and 183 from sugar beets. Velocity measurements for the preceding years of alfalfa will be reviewed to see if they shed any additional light on this subject."

Irrigation Studies - V. E. Hansen, Logan, Utah.-"Line and work project plans were completed as well as the annual report for the project entitled, 'Water Requirements, Irrigation Efficiencies, and Methods of Water Application.' The annual report dealing with the irrigation phases of the above project was combined with the reports on the soils and plant phases prepared by representatives of the Utah State Experiment Station and the BPISAE. This combined annual report entitled, 'Irrigation and Soil Management Studies Including Drainage, Salinity, and Fertilization' is being distributed to all cooperators."

Irrigation Studies - C. W. Lauritzen, Logan, Utah.-"Annual reports have been completed for Project R-3-6-1, 'Permeability and Stability of Soil and Soil Materials,' and Project R-3-2-3, 'Lining of Irrigation Canals and Ditches.'

Irrigation Studies - W. C. Barrett, Logan, Utah.-"Analysis of this year's field work in Vernal and Ferron in soil moisture and depletion by various crops has progressed to the point where rough cast-ups of the results have been made. The method and early results of this analysis give prospects of fair agreement with last year's results.

2/16/50